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Your reference	GPS/BP6051536
Patent application number *(The Patent Office will fill in this part)*	0208806.0 17 APR 2002
Full name, address and postcode of the or of each applicant *(underline all surnames)* Patents ADP number *(if you know it)*	RIEKE CORPORATION 500 WEST 7TH STREET AUBURN INDIANA 46706 USA 688317001
f the applicant is a corporate body, give the country/state of its incorporation	USA
4. Title of the invention	DISPENSER PUMPS
5. Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)* Patents ADP number *(if you know it)*	MEWBURN ELLIS YORK HOUSE 23 KINGSWAY LONDON WC2B 6HP 109006

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer "Yes" if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))*	YES

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Priority documents	0
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
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Request for substantive examination *(Patents Form 10/77)*	0
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11. I/We request the grant of a patent on the basis of this application.

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Date
16 April 2002

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DISPENSER PUMPS

This application relates to developments in relation to dispenser pumps which dispense foam.

Our earlier application EP-A-1190775 describes various developments in relation to dispenser pumps adapted to dispense foam by combining pumped flows of air and liquid and passing them through a permeable foaming element. While the concepts and indeed the embodiments described in the earlier application may - as a skilled person would readily appreciate - be used in or adapted for any inverted dispenser, we have now made some further developments particularly appropriate for an inverted dispenser. We have also made some further developments usable in but not necessarily limited to use in inverted dispensers.

Inverted dispensers e.g. for liquid soap and the like are well known in themselves. Typically they involve some housing or mounting on which a container is mounted upside down, with a mouth of the container communicating with the intake of a dispenser pump. The pump is operated by a reciprocating action to move its pump piston. Usually the pump piston is arranged more or less upright, but this is not essential. The dispenser arrangement may include a mechanism whereby movement of an operating part with a substantial horizontal component - this being usually more convenient for the user - is

converted to a driving movement along the line of the pump plunger axis e.g. by cams, pivots and the like.

Inverted pump dispensers adapted to dispense foam have also been proposed before; see e.g. US 5445288 (EP 703831) describing a system for use with collapsible containers, also WO 99/49769.

In general terms, the present proposals relate to dispensers (referred to in what follows as "of the kind described") which combine a liquid pump and an air pump mounted at, or adapted to be mounted at, the neck of a container which contains foamable liquid. The liquid pump has a liquid pump chamber defined between a liquid cylinder and a liquid piston, and the air pump has an air pump chamber defined between an air cylinder and an air piston. Preferably these components are arranged concentrically around a plunger axis of the pump. The liquid piston and air piston are reciprocable together in their respective cylinders by the action of a pump plunger; typically the two pistons are integrated with the plunger. Appropriate flow valves are provided to assure the operation of the respective pumps. Thus, the air chamber typically has an air inlet valve. The liquid chamber may or may not have a liquid inlet valve. An air discharge passage and a liquid discharge passage lead from the respective chambers to an outlet passage by way of a permeable foam-regulating element, preferably having one or more mesh layers or other porous formation, through which the air and liquid pass as a mixture. The

air discharge passage and liquid discharge passage may meet in a mixing chamber or mixing region upstream of the permeable foam-generating element. Either or both of an air outlet valve and a liquid outlet valve may be provided for the air discharge passage and the liquid discharge passage respectively.

Our earlier application EP-A-1190775 discloses various proposals relating to the feeding of external air to the air cylinder, to the construction of an air inlet valve integrally with the air piston or a portion thereof, to possible constructions for a mixing chamber for liquid and air, to a novel disposition of the discharge passageways, and to arrangements for venting air into the container. The present pumps may incorporate any one or more of those earlier proposals, as defined in the earlier application.

A typical feature of inverted dispensers is the prevailing presence of liquid under pressure adjacent the pump inlet and securement to the container mouth. Thus, the liquid chamber inlet may be simplified. Indeed, an inlet valve may be omitted altogether. To control the flow however we prefer to use an inlet valve urged, preferably resiliently, towards its closed position.

Another issue is venting of the container interior. In an inverted dispenser arrangement such venting may be omitted altogether (for a collapsible container), shifted to the base (top) of the container away from the pump, or provided adjacent the container mouth but bypassing the

air cylinder of the pump to avoid the risk of liquid from the container working its way into this air cylinder. A discrete venting valve may be provided to inhibit escape of liquid.

In a particular feature proposed in the present disclosure we propose positioning the air inlet valve outwardly (that is to say, below, in the inverted operating position of the pump) of the entrance to the foam-generating element. Expressed in another way, the air chamber axially overlaps or encloses at least part of an preferably most or all of the foam-generation/regulation element. Additionally or alternatively, the air inlet valve is axially outward of the air outlet valve. This enables a very axially compact construction. In an inverted dispenser, it takes advantage of the lesser need to have an exposed plunger cap of appreciable length. In an inverted dispenser, this area may be acted on by a mechanism rather than directly by a user's hand.

In one possible construction an outer cap component including a discharge nozzle includes a recess for receiving a foam-generating element in communication with the nozzle and a radially-extending cap wall with a sealing abutment for the air inlet valve flap on its inner surface. One or more air intake holes for the air chamber is/are provided through the cap wall, communicating with a space isolated by the valve sealing abutment and the valve flap.

The recess for the foam-generating element may be provided by a tubular inward extension of the cap, projecting further inward than the sealing abutment for the air inlet valve.

A further independent proposal herein, in the context of a foam dispenser of the kind described, is the provision of an inlet conduit for the liquid pump specially adapted to improve the clearance of liquid from the inverted container. Typically the liquid pump cylinder projects up (in the inverted configuration) into the container space to an appreciable extent. If the intake opening to the liquid pump chamber - typically having a liquid inlet valve - is at this upper end of the pump body, then depending on the shape of the container neck and pump mounting there may be a significant body of liquid in the system below the level of the intake opening. To avoid wasting this liquid, we propose providing a conduit communicating at its downstream end with the intake opening to the liquid pump chamber and extending downwardly from there to an inlet opening at its upstream end. This liquid conduit may extend down alongside the liquid cylinder and/or the air cylinder of the pump arrangement. Its inlet opening (upstream end) preferably lies below the axial position of the seal of the liquid piston, in the inverted (operating) position of the dispenser with the plunger extended/retracted to its downward position. The uptake opening may lie within

the shape envelope defined by a securing cap of the dispenser.

The conduit may be provided as a dip tube extending down from a releasable connection at the intake end of the liquid pump chamber.

A further independent proposal - which, as with the others, may be combined with any one or more of the other proposals herein - relates to the control of unwanted flow, leaking or drips from a downwardly-directed discharge nozzle of the dispenser, downstream of the foam-generating element. We propose a closure valve for the discharge nozzle comprising a wall of resiliently flexible material having one or more discharge openings e.g. in slit form, closed in a rest condition of the wall and open when the wall is caused to bulge outwardly under pressure from product discharged from the pump. A rubber membrane with one or more slit openings is preferred e.g. crossed slits. Preferably the wall is downwardly concave, so that under forward fluid pressure it must pass through a peak of compressive strain before reaching a wholly or partially outwardly convex configuration in which the discharge opening opens. Closure valves of this kind are known as such. They offer the advantage of a positive closure action when pump pressure is relieved, because the resilient restoration of the material presses the sides of the discharge opening(s) together as the wall returns to its rest condition.

Embodiments of these various aspects of our proposals are described in relation to

Fig. 1 which shows an axial section of a pump for an inverted soap dispenser;

Fig. 2 which is a corresponding view of a slight variant of the Fig. 1 pump;

Fig. 3 which is an inlet-end view, and

Fig. 4 which is an axial section of a further version of inverted dispenser.

With reference to Fig. 1, the functional components of the dispenser broadly correspond with those of the upright dispensers described in the earlier application, and reference numerals correspond. Thus, an air piston 2 is joined to a cap 5 of a plunger 1. An air chamber 16 is defined between the air piston/cap and a cylinder defined by the interior of a cap cylinder which, rather than sitting inside the neck of the container (not shown) as in the earlier application, extends out below and around it. The top of the plunger stem 13 carries a sliding piston seal 41 operating in a liquid cylinder 102 defining a liquid pump chamber 14. Liquid from the pump chamber 14 and air from the air chamber 16 are pumped together, via the sliding valve 41 and an air outlet valve 341, to an air chamber 17 defined between the pump core 3 and the air outlet valve 341; the pumped air mixes with the pumped liquid in a mixing region 180 immediately upstream of a foam regulating element 8 carrying meshes 81,82 and housed in a socket 11 of the plunger cap 5.

Because no dip tube is needed, the inlet to the liquid chamber 14 is provided directly through a set of radial windows 99 in the base (top) of the liquid cylinder 102. See also Fig. 3. An elastomeric flap valve 98 in the form of an umbrella keeps these inlet openings shut except when the return stroke of the pump draws replacement liquid into the liquid chamber 14.

The venting arrangement for the container is also distinctive. Instead of providing for communication of venting air through the air chamber 16, the present construction leaks air through the cap around the side of the air chamber through a small and tortuous channel 291. This communicates to behind an elastomeric vent sealing ring 292 which engages the outer surface of the cylinder construction to prevent a reverse flow of liquid out through the vent opening 291. It will be noted that in this pump the cylinder unit is made from two components rather than one.

The air flow out of the air chamber 16 is via a radially-inwardly projecting resilient valve flap 341 which engages a ledge 131 of the piston stem as in the previous embodiments. This valve flap 341 is carried on a core sleeve extension 34 as in the first embodiment of EP-A-1190775. This core sleeve extension fits onto a central pump core 3 which, again as in the previous embodiments, includes a downward (outward) sleeve 32 enclosing the upper (inward) part of the tubular foam-generating element 8. A tubular upward (inward)

extension 11 of the bottom cap 1 fits into this to trap the foam-generating element 8 in place.

Distinctively, in the present embodiment the central core 3 is contained entirely within the air chamber 16.

The top plunger element 1 has a cap 5 which, rather than being axially elongate as in previous embodiments (in EP-A-1190775), is essentially a flat radial plate with the discharge spout 12 projecting outwardly and the securing sleeve 11 projecting inwardly from its centre, as integral extensions. The outer sleeve 23 of the air piston snaps into an outer securing skirt of this cap plate 5 immediately inward of the plate level, so that the air piston seal 21 is generally in axial alignment with the core 3.

The inward (upward) surface of the cap plate 5 carries an annular bead 55 and has some through-holes 19 in the area between the bead 55 and the outer edge. The inwardly projecting annular valve flap 24 formed integrally on the air piston sleeve 23 engages this annular rib 55 with its sealing edge to create the air inlet valve. Thus, in this construction the tiny volume between the cap plate 5 and the air inlet valve 24 corresponds to the large interior space 51 of the plunger cap in the previous upright embodiment. The foam-generation system is recessed almost entirely within the air cylinder, so that the pump construction as a whole is very compact.

Fig. 2 shows a second embodiment. Here the air cylinder, the liquid cylinder and the securing thread for both of these are formed in one piece.

There is also a difference in the venting of the container. In this version the vent channel 291′ does not pass through the cap wall to the exterior. Instead it passes around behind the elastomeric seal 292 and opens to the interior of the cap, just outwardly of the series of threads. It has been found that air-permeability of the threaded engagement can be adequate for container venting, having in mind the relatively small amount of liquid that needs to be dispensed to create a substantial dose of foam.

Fig. 4 shows a further embodiment of inverted dispenser. Here the disposition of the air cylinder and liquid cylinder is again in a single moulded piece, as in Fig. 2, but adopts a position wholly inside (above) the securing cap of the dispenser. With the air and liquid chambers not overlapping axially, this raises the liquid intake (shown with an umbrella valve 98) well above the bottom of the body of liquid in the container, raising the issue of how to clear this portion of liquid from the container. This is addressed by providing a dip tube 333 which connects into an adaptor 111 at the top of the liquid chamber that extends down alongside the liquid cylinder 102 and air cylinder 101 to reach down into the space 303 in between the outer securing cap 106 and the wall of the air cylinder 101.

A further feature in this embodiment is the tapered construction of the lip of the air vent valve 392. Because the wall of the air cylinder 101 is substantially axial, the lip of the seal 392 is inclined acutely to the pump axis to give adequate sealing tolerance.

A further feature of this pump is the construction of the discharge nozzle 312. A rubber anti-drip valve 313 is fixed in the nozzle, clamped by a securing ring 314. The valve 313 has an annular front securing bead 315, a cylindrical rearwardly-extending continuous wall 316 and a concave closure wall 317 traversed by a pair of crossed slits. These valves are known as such, obtainable from Zeller. Normally the closure slits are fully shut. Under pressure from dispensed product, the closure wall 317 bulges forward, opening the slits for the passage of product. When pressure is released, the closure wall spontaneously retracts, closing the slits and preventing subsequent dripping. It also leaves the immediate opening of the nozzle 312 clear of product so that a user reaching under the nozzle 312 does not unexpectedly get product on their hands before operating the pump.

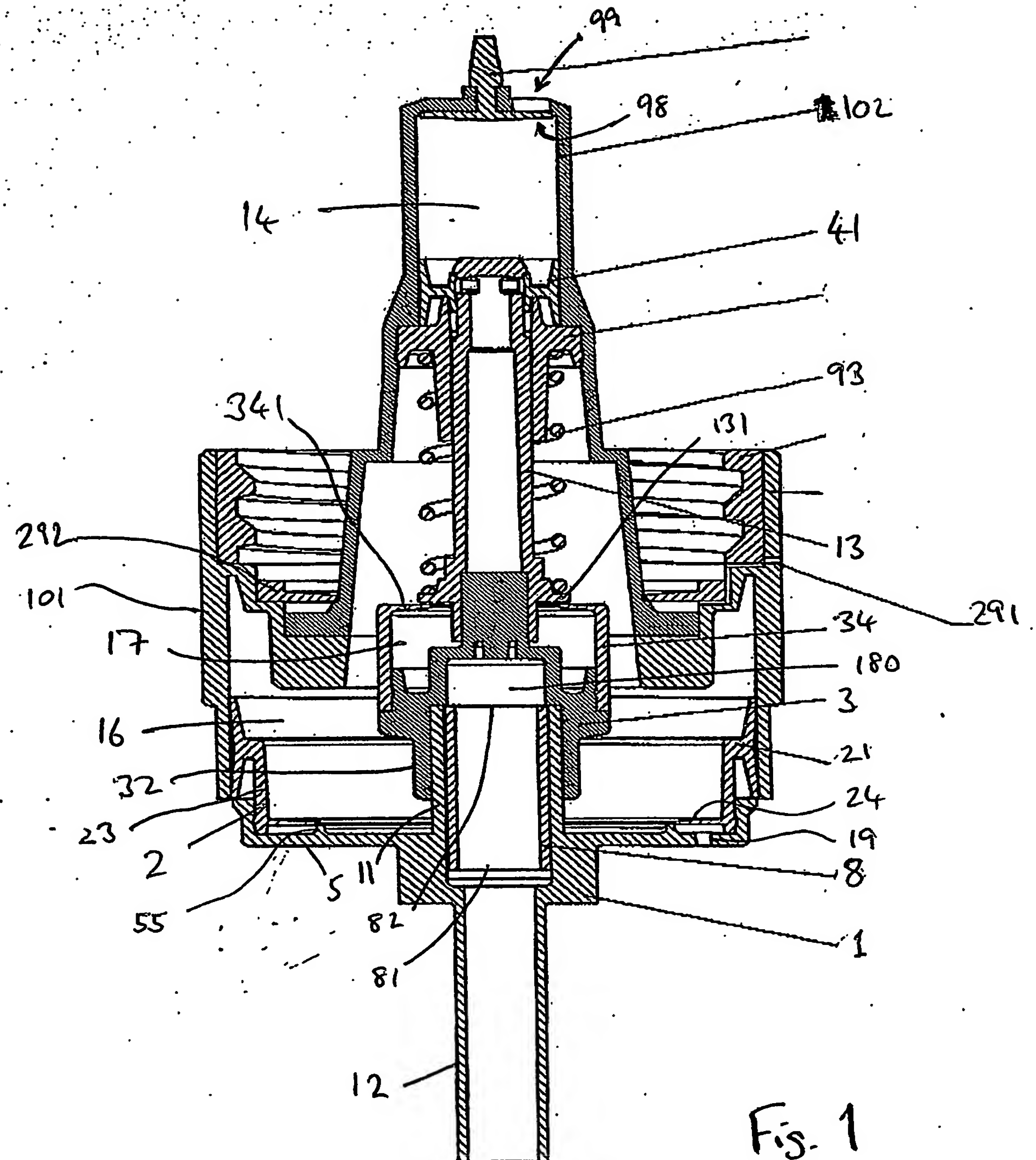
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Fig. 1

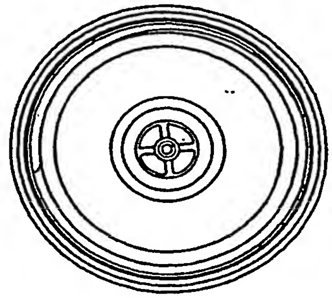

Fig.3

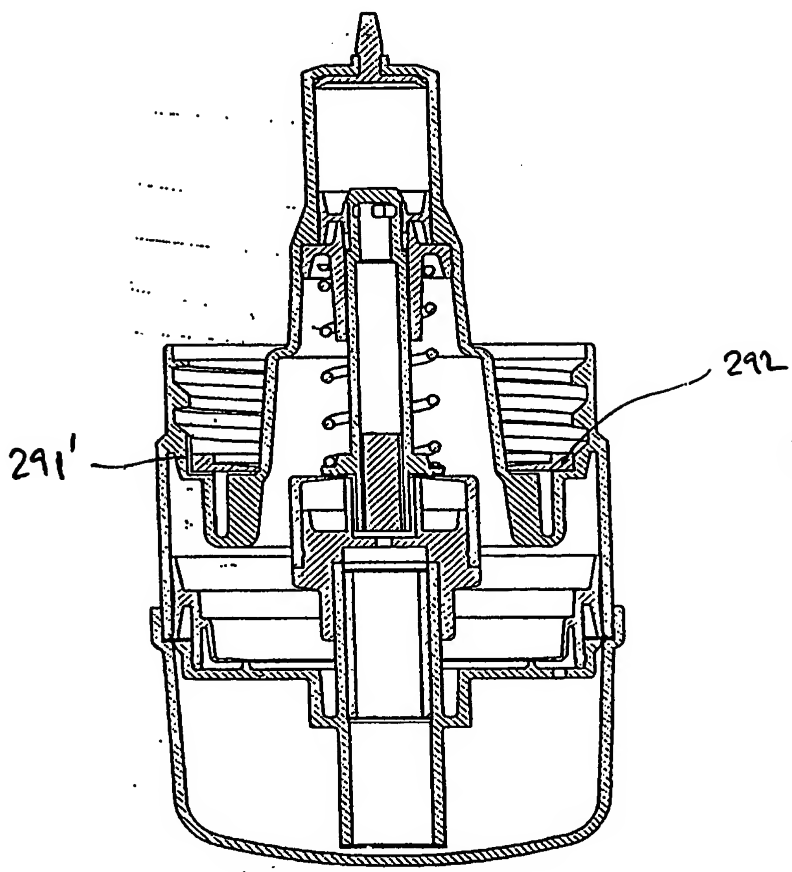

Fig.2

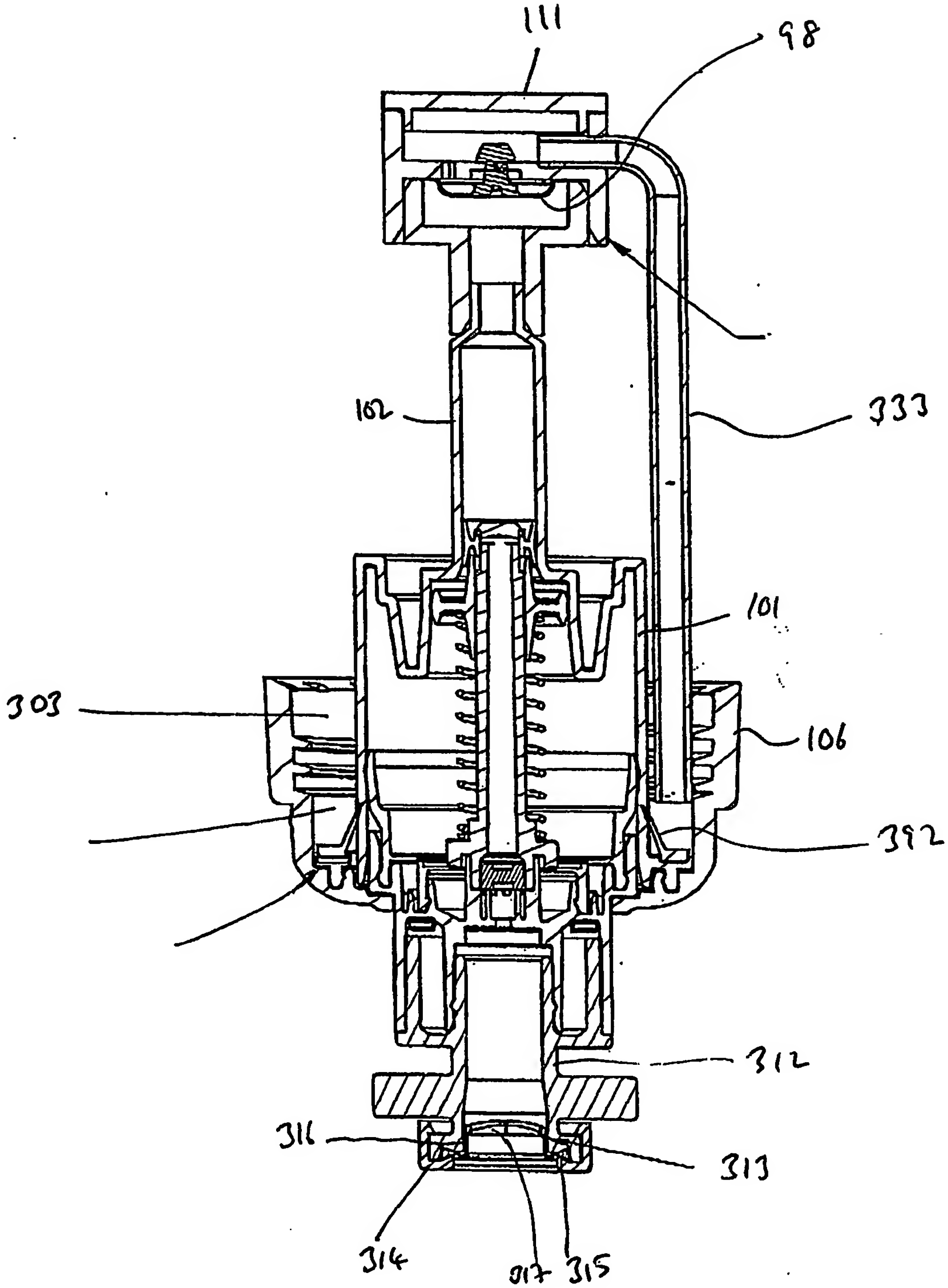

Fig. 4